Driver Drowsiness Detection

An Engineering Project in Community Service

Final Report

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Bonafide Certificate

Certified that this project report titled **"Driver Drowsiness Detection"** is the bonafide work of "(21BAI10227) Harish L,(21BAI10445) Dhananchezhiyan S, (21BCE10752) Nitish K, (21BCE10890) Tamilarasan V, (21BCE10937) Apoorv Pradhan, (21BCE10940) Nikhil Kumar, (21MIM10053) Akshaay, (21MEI10059) Tharun PMR**"** who carried out the project work under my supervision.

This project report (Phase II) is submitted for the Project Viva-Voce examination held on 10th May 2024

Supervisor

Comments & Signature (Reviewer 1)

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Declaration of Originality

We, hereby declare that this report entitled”Driver Drowsiness Detection”represents our original work carried out for the EPICS project as a student of VIT Bhopal University and, to the best of our knowledge, it contains no material previously published or written by another person, nor any material presented for the award of any other degree or diploma of VIT Bhopal University or any other institution. Works of other authors cited in this report have been duly acknowledged under the section ''References''.

Date:10/5/2024

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We extend our heartfelt gratitude to all those who contributed to the completion of this report on driver drowsiness detection using deep learning model. Our sincere thanks to our supervisor and reviewer, whose expertise and guidance were invaluable throughout the research process. We also express our appreciation to the participants who generously shared their insights and experiences, enabling us to enrich this study. Additionally, we acknowledge the support received from our college, VIT Bhopal, without which this endeavor would not have been possible.

Abstract

Alerting the driver when he is drowsy without his knowledge while driving by deep learning model which gives responses in quick.The deep learning model we used is transfer learning,which transfer the knowledge from previous work.Then for the face detection we used haar cascade algorithm.For virtual testing we used proteus software and for the connector we used vspe simulator port to convert our python code .This project will help environment in terms of reducing accident and moreover it will safe opposite car drivers,passsengers.

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1. INTRODUCTION

Based on 2017 police and hospital reports, the National Highway Traffic Safety Administration (NHTSA) identified 91,000 car accidents as being caused by drowsy drivers. Even though the state of drowsiness may only last for a few minutes, its consequences can be disastrous.Driving fatigue can be triggered by a variety of circumstances, such as prolonged work hours, side effects of prescription medications.

Driver drowsiness, often referred to as fatigue, impairs cognitive function, reaction time, and overall alertness, thereby increasing the risk of accidents. According to statistics from road safety organizations, a substantial proportion of accidents are attributed to driver fatigue, especially during long journeys or late-night driving.

Recognizing the imperative to address this issue, automotive manufacturers and researchers have developed innovative solutions in the form of driver drowsiness detection systems. These systems leverage a combination of sensors, cameras, and algorithms to monitor various parameters indicative of driver alertness. In recent years, advancements in automotive technology have brought about significant improvements in vehicle safety features aimed at reducing the occurrence of accidents and fatalities on our roads. One critical area of focus within this realm is the detection and mitigation of driver drowsiness, a prevalent yet often overlooked factor contributing to road accidents worldwide.

1.1 Motivation

The motivation behind the development and implementation of driver drowsiness detection systems is multifaceted and deeply rooted in the overarching goal of enhancing road safety. Central to this motivation is the recognition of the grave consequences associated with drowsy driving, which often leads to accidents resulting in injuries and fatalities that could be prevented with timely intervention. By alerting drivers to their drowsy state, these systems aim to mitigate the risk of accidents caused by impaired alertness, thus saving lives and reducing the economic and social costs associated with road traffic collisions. Moreover, the public health impact of drowsy driving cannot be overstated, as it not only jeopardizes the safety of individual drivers but also poses risks to passengers, pedestrians, and other road users.

In response to growing concerns about drowsy driving, regulatory bodies are implementing stricter regulations, driving automotive manufacturers to develop and integrate drowsiness detection systems to comply with these standards and demonstrate their commitment to road safety. Additionally, the evolution of these systems underscores ongoing technological innovation in the automotive industry, as stakeholders leverage advancements in sensor technology, artificial intelligence, and human-machine interaction to push the boundaries of safety and comfort for drivers and passengers alike. Ultimately, the motivation behind driver drowsiness detection systems reflects a blend of safety imperatives, technological progress, and corporate responsibility to prioritize the well-being of individuals on the roadways

1.2 Objective

Aim of this driver drowsiness detection project is to develop a system that can identify signs of driver drowsiness in real time and alert the driver by alarm. As it's risk factor for road accidents, injuries and fatalities. Another motive of this project providing an opportunity for research and development in the fields of Computer vision, Machine learning and Human computer interaction.

Systems that assist in monitoring driver fatigue, use sensors to observe a driver's eye movements, breathing patterns, and yawning to detect when they are exhausted and warn them in time to prevent an accident. Frequent yawning, drowsiness that comes and goes, and missing turns are just a few indications of drowsy driving that should notify people to the need of stop driving.

There are various ways to identify this issue firstly, image-based measures that are obtained using a camera to analyse the driver's movements and facial expressions. secondly, biological-based measures that relate to the driver's bio-signals and can be recorded by placing special sensors on the driver's body. thirdly, vehicle-based measures, which depend on monitoring the behaviour and movement of the vehicle.But here we are going with mobile net model with eye ratio

2. Existing Work / Literature Review

1. **Ramzan et al (2019)** he used to monitors the drivers' physical behavior, vehicular movement pattern. He used Percentage of eye Closures (PERCLOS) metrics in drowsiness detection. To detect the ROI (face and eyes), viola jones method is used. SVM classifiers which gives better accuracy and speed, but not suitable for large datasets. HMM shows a less error rate, but both CNN and HMM are slow in training and expensive as compared to SVM classifier.
2. **Fuletra J.D, Bosamiya**. A nonintrusive prototype computer vision system for monitoring a driver's vigilance in real time is proposed image acquisition,pupil detection and tracking, visual behaviors and driver vigilance. They used fuzzy classifier, PERCLOS,ELDC,ROT.The main disadvantage of our system is the face tracking method which is inaccurate and very computationally complex.
3. **Rupinder Kaur, Karamjeet Singh el al** Drowsiness Detection based on EEG Signal analysis using EMD and trained Neural Network. MATLAB algorithm used. Achieved promising results with 88.2% correct detections and a 11.8% false alarm rate across eight subjects. While the current neural network is trained up to 83.6%
4. **Jongseong gawk**, **akinari hirao**, **motoki Shino el al** Driver drowsiness, hybrid sensing, ML, Physiological signal, RF impressive accuracy 82.4% for distinguishing alert, Notably, the random forest algorithm demonstrated efficacy with 78.7% accuracy.
5. **Venkata rami reddy**, S**rinivasulu reddy el al** viola-jones, stacked deep convolution neural network, SoftMax layer, CNN. The system achieves a remarkable 96.42% accuracy.
6. **Bamidele study (2019)** focuses on a low-cost, nonintrusive drowsiness detection method using face and eye tracking. Despite achieving 70-75% accuracy, challenges include hardware complexity, lighting conditions, and glare interference.
7. **Luis M. Bergasa (2007)** she developed computer vision system monitors driver vigilance in real-time by analyzing six parameters merged. Achieved close to 100% accuracy in ideal conditions but performing robustly at night but faces challenges with daytime operation and drivers wearing glasses.
8. **Jay D. Fuletra's (2007)** study evaluates drowsiness detection techniques, EEG-based methods Image Processing techniques face challenges with driver spectacles but hold potential with ongoing research efforts.
9. **Toshiya Arakawa (2021)** study reviews arousal detection methods for autonomous driving levels 4 and 5, noting machine learning's potential to enhance accuracy. It faces challenges in real world testing and ethical considerations.

3. Topic of work

a) System Architecture

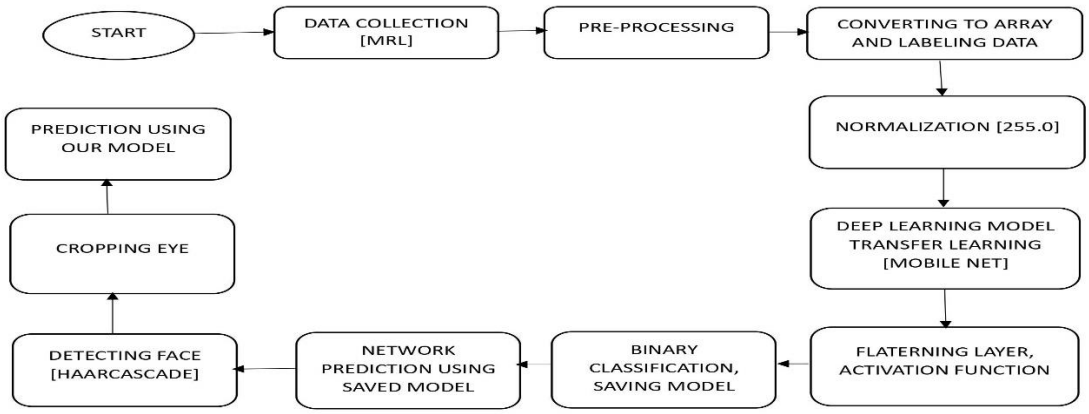

Fig 3.1- System flow diagram of model development

b) Working Principle

- Real Time capturing: Here we are gonna use open source computer vision for capturing user face via camera,as we are using laptop camera so value in videocapture is 0,if its 1 means it will detect from external webcam.

- Image extraction: Once we get the video fram of the driver it will be changed to gray scale and feeded into haar cascade algorithm,then with region of interest we frame the box of eyes

- Pre-processing: Once we get the cropped image we will get expand it into four deimensions representing number of images or data following that we have height and width values of 224 at last it shows no of channels .Then we normalize it and predict it with our saved model that we created.

- Alerting: finally our model will predict whether eyes are opened or closed from our created model,we have given green color box frame for open eye and red box frame for closed eye.So if it shows red box the alarm starts to beep.

- Virtual testing: Here we have use virtual testing for our model to implement into real world for this we have used proteus software and Vspe.There for the monitor we have used raperry pi and made a circuit and did source code according to the circuit.In that we conntected it with compin so that from we connect it to Vspe for visual com port.If we run the pyhton code outer and when cam is on it will connect to the schematic circuit . Basically this is the outlayer for our model to implement it to real world(fig 3.2)

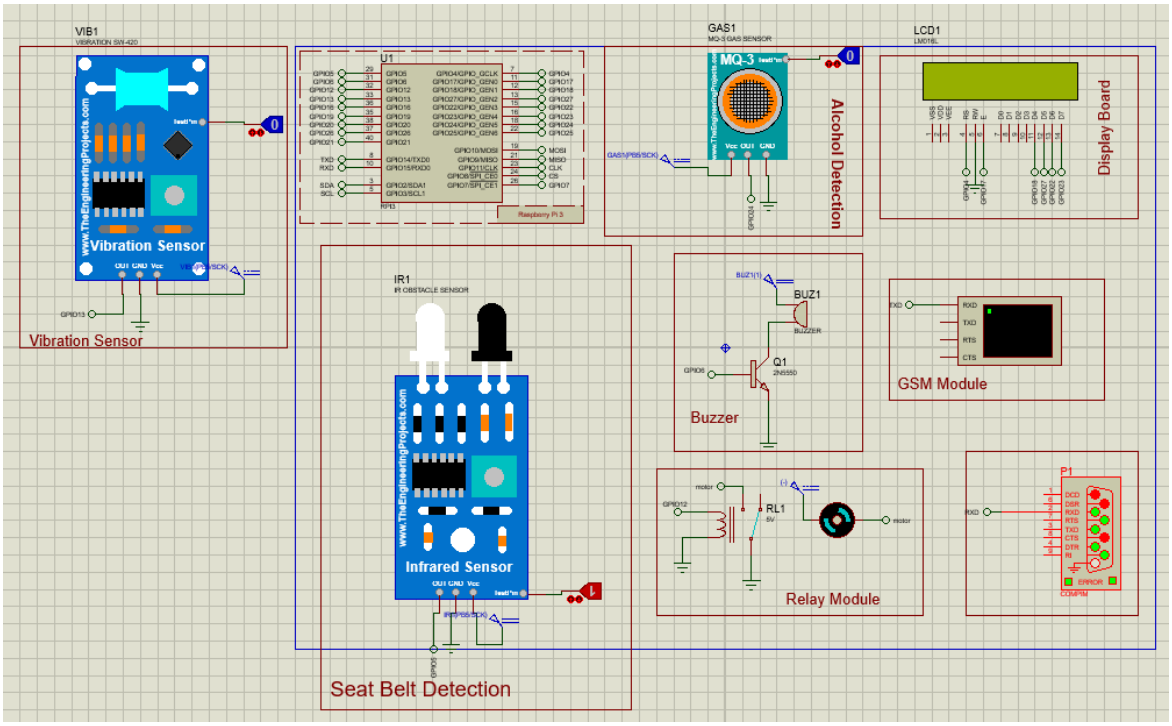

Fig 3.2 Proteus circuit for virtual testing

c) Results

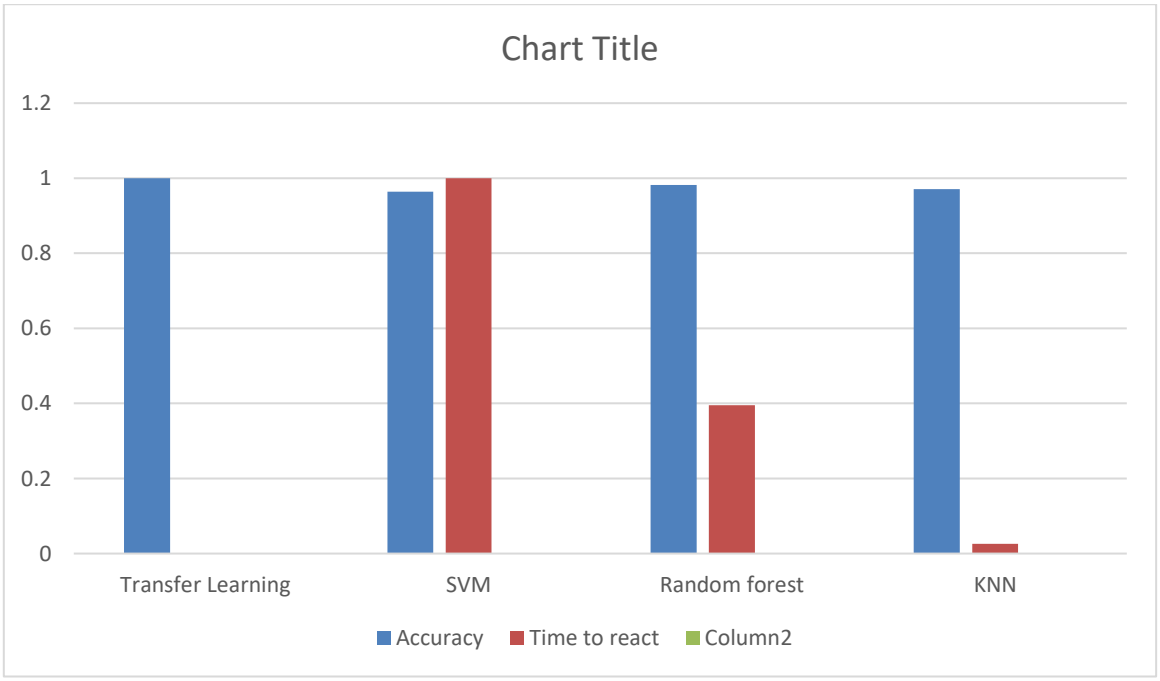

Fig 3.3 Comparison graph with other models

In result our transfer learning model gives more accuracy than other models as well as it takes quicker time to react.In (fig 3.3) the blue bar represents the accuracy and the brow box represent the the model taking time to react.Transfer learning model has accuracy of 1 and takes 0.50ms to 100 ms time to react,SVM has accuracy of 0.964 and takes 1 sec to react,Random forest has accuracy of 0.98 and takes 385ms to react,KNN accuracy of 0.971 and 2ms to react.

Transfer learning models often surpass SVM, KNN, and random forests due to their pre-trained knowledge, which offers rich feature representations and adaptability to new tasks. They require less labeled data, are adept at domain adaptation, and can capture complex relationships in data through hierarchical learning. Additionally, the availability of pre-trained models accelerates model development and deployment. While traditional algorithms have their merits, transfer learning models excel in handling large-scale, complex datasets and scenarios with limited labeled data.

4. Conclusion

In this report, we presented a comprehensive methodology for developing a driver drowsiness detection system using transfer learning with a MobileNet model through importing Keras model. By leveraging pre-trained Deep Learning model and Haar cascades for face and eye detection, we aimed to accurately classify whether a driver's eyes are open or closed, a crucial indicator of drowsiness.

Through the integration of transfer learning, we were able to harness the knowledge encoded in pre-trained models such as MobileNet, Adam optimizing both training time and performance. The utilization of Haar cascades enabled efficient detection of facial features, particularly eyes, with random sample face image , facilitating the input to our Binary Classification model.

Our approach involved thorough data preprocessing, model construction, training, and evaluation, culminating in the deployment of the trained model into a real-world application. By incorporating techniques such as flattening,sigmoid as activation function, and compilation pickle for data saving in disk, we aimed to maximize the accuracy of the drowsiness detection system.

So that we have used MobileNet model to keep learning simple but we have various pre trained model like SVM and so on we can use it according to out need,we used this model because its light in nature and have decent accuracy rate.Binary classification because we have only two class of open eye and close eye.Activation function is sigmoid in our case because only two class are used.The problem we faced here is as pickle cannot store large data we could train only 3800 aprox samples,but we have more than 27,000 samples.As expected we able to predict the eyes is opened or closed with (0.5 to 1) and (o to 0.5) output respectively.We have compared

it with some other models like knn,svm with our model in result our model gives slighter higher accuracy as well time taken to react is faster in our model.

In our final phase we have created a virtual testing model using proteus software with raspberry pi for the monitor roll ,included led and buzzer .Adding to that we have used virtual serial port emulator for connecting our schematic circuit to the server.so when we run our python code and cam is on the led in that circuit will display the state,if it display drowsy the buzzer start to give beep sound.

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6. Biodata with Photos:

I am Harish L currently pursuing in AIML.I have a intermediate level of coding level knowledge in python which is useful for my domain of machine learning. I have skills in machine learning libraries such as tensor flow, keras and with this project I hot idea about mobile net model. In this project I have contribute in research part for literature review, collection in data's as well as in coding part and I am very much eager to make this model into real world application.

I am Dhananchezhiyan S currently pursuing a Bachelor's degree in (B.Tech) computer science with specialization in Artificial intelligence and machine learning. Armed with a strong foundation in Python programming, I am delving deep into the realms of artificial intelligence and machine learning. I will actively seek opportunities to apply my knowledge and collaborate on innovative projects. With a blend of theoretical understanding and practical expertise, I am aspiring to make meaningful contributions to the ever-evolving landscape of artificial intelligence. I have contributed in data collection, segregation and literature review part.

I am Nitish K skilled in MERN- STACK developer with expertise in a wide range of technologies. I am proficient in MongoDB for database management, Express.js for building web applications and APIs, React.js for frontend development, and Node.js for server-side scripting and adding to that proficiency extends to frontend technologies including HTML5, CSS3, JavaScript (including ES6+), and frameworks like Bootstrap for responsive web design. I am experienced in state management using Redux. I have helped in training of this model and in collection of dataset, segregation of the dataset.

I am Tamilarasan currently pursuing Bachelor's degree in Computer Science Engineering (CSE) and specializes in Core Javaprogramming ,HTML5,CSS. With a burgeoning interest in software development, committed to refining my skills in Java for backend development, and HTML/CSS for frontend web development. I am eager to pursue a career in web development and contribute to this projects. I have helped for research work and testing model for this project.

I am Akshaay currently pursuing an Integrated M.Tech degree in Computer Science with a specialization in Artificial Intelligence and Machine Learning from VIT Bhopal. Possessing expertise in Python, Machine Learning, and Deep Learning, I am dedicated to becoming a Machine Learning Engineer. Iam committed to continuous learning and growth in the field of technology, eager to contribute his expertise towards innovative solutions in the realm of Artificial Intelligence and Machine Learning. I have contributed coding part in this project.

I am Apoorv Pradhan currently pursuing B.Tech degree in Computer Science Engineering from VIT Bhopal. My academic journey has provided me with a good understanding of computer science and I specialize in front-end development with a skill-set comprising of HTML, CSS, Java Script, UI/UX & Figma. I am also interested in Cloud computing & have cleared AWS Cloud Practitioner exam. I am also learning C++ and Python, and exploring the field of AI & Machine Learning.

I am Nikhil Kumar currently pursuing a B.Tech degree in Computer Science Engineering from VIT Bhopal, specializing in the core branch. Possessing skills in HTML, CSS, JavaScript, and UI/UX design, I has also cleared the AWS Cloud Practitioner exam. With a career objective of becoming a full stack developer, I am dedicated to continuous learning and growth in the field of technology.I have actively seeks opportunities to apply his knowledge and expand his expertise.

I am Tharun Kumar pursuing an MTech in Cyber Security while concurrently learning web development and Python programming. With a focus on cybersecurity, I am adapting to understand the complex systems and implementing robust security measures. Tharun's interest in web development and Python underscores his commitment to versatile skill-building. Connect with Tharun to witness his journey in bridging cybersecurity with cutting-edge technologies. I have contributed in report work of this project and collecting samples for this project to make accuracy more.